

LESSON 5: Using Compost and Promoting Vermicomposting

Note: If your worm bin is not ready for harvesting, you can still implement “Part III” and “Part IV” in this lesson.

LESSON'S CONCEPTS

- Red worms turn food and paper waste into compost that can be used to enrich soil.
- People can participate in actions that enhance their environment.

PURPOSE

Students will learn ways to harvest and use worm compost. They also share information about red worms and vermicomposting with other students.

OVERVIEW

In this lesson students will:

- Harvest the vermicompost from the worm bin.
- Conduct an experiment to test whether worm compost affects plant growth.
- Read or listen to *Miss Rumphius* by Barbara Cooney and *Johnny Appleseed* by Eva Moore and discuss the special things each character did to improve the environment.
- Make a red worm mascot, puppet, or clay model and use these to share what they know about red worms and vermicomposting.
- Write poems, songs, and stories or design murals, illustrations, and posters to teach others about the importance of vermicomposting.

CORRELATIONS TO CALIFORNIA'S CONTENT STANDARDS AND FRAMEWORKS AND TO BENCHMARKS FOR SCIENCE LITERACY

- Students use puppets or clay models to share what they know about red worms and vermicomposting with classmates and design posters to share information with other students in their school.

- “People can learn from each other by telling and listening, showing and watching, and imitating what others do.” (*Benchmarks for Science Literacy*, page 140)
- “Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept . . . students will . . . communicate observations orally and in drawings.” (*Science Content Standards, Grades K–12; Kindergarten; Investigation and Experimentation*, Standard 4e)
- Students read (or listen to) *Miss Rumphius* by Barbara Cooney and *Johnny Appleseed* by Eva Moore.
 - “Students identify the basic facts and ideas in what they have read, heard, or viewed.” (*English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 2)

SCIENTIFIC THINKING PROCESSES

observing, communicating, comparing

TIME

10–20 minutes to prepare for the lesson; 60 minutes for two days to implement the lesson, plus time over several weeks to gather information as the plants are growing in different types of soils

VOCABULARY

Ask students to select words they are curious about that apply to this lesson.

PREPARATION

- ___ 1. Read the "Background Information for the Teacher" at the end of this lesson.
- ___ 2. Obtain six potted plants of the same species. (You might be able to get some slightly unhealthy looking plants donated by a nursery or donated by a parent.)
- ___ 3. Ask students to bring one clean sock to class so each student can make a red worm puppet. (Bring some extra socks for those students who could not bring them.)

MATERIALS

For "Part I, Separating the Compost from the Worms"

- ___ A sheet of plastic (or a drop cloth or plastic table cloth) approximately 4 feet to 6 feet square
- ___ Three 1-gallon-size containers to separate worms, bedding, and castings (The cafeteria may have some containers.)

For "Part II, Testing Whether Worm Compost Affects Plant Growth"

- ___ Six potted plants of the same species
- ___ Soil
- ___ Poor quality soil, such as sandy or clay soil
- ___ Worm compost

For "Part III, Reading or Listening to the Stories, Miss Rumphius and Johnny Appleseed"

- ___ The books, *Miss Rumphius* by Barbara Cooney and *Johnny Appleseed* by Eva Moore

For "Part IV, Making a Worm Mascot, a Sock Puppet, or a Clay Model"

- ___ Transparency of "A Red Worm" from Lesson 2

For the Worm Mascot

- ___ One tan-colored nylon stocking
- ___ One nylon stocking in a lighter shade
- ___ Newspaper
- ___ Construction paper
- ___ String or yarn
- ___ Other items for decorating the worm mascot (See "Making a Worm Mascot" on page 155)

For the Sock Puppet

- ___ One clean sock for each student
- ___ Markers
- ___ Construction paper

- ___ Glue
- ___ Scissors
- ___ Yarn

For the Clay Model

- ___ Red or brown modeling clay

PRE-ACTIVITY QUESTIONS

- A. Ask students to look inside the vermicomposting bin and determine how the rich compost can be separated from the worms. List their ideas on the chalkboard. *Pick out worms; put all the food on one side and wait until the worms move to that side; take out one handful at a time and separate the worms from the compost; dump the bin's contents on a plastic sheet and separate worms from the castings.*
- B. Discuss with students what could be done with the compost from the vermicomposting bin. (This discussion will be continued in "Part I," section "D.") *Plant plants in soil mixed with the compost; put it in a container and see if worms hatch; put around trees; put in the garden; put in soil of potted plants.*

PROCEDURE

Part I, Separating the Compost from the Worms

- A. When the compost is ready:
 - Allow groups of students to try the various methods the class has recommended in their responses to the "Pre-activity Questions."
 - Assign one group to follow the procedure on how to harvest the compost described in "Background Information for the Teacher." (Dump three-fourths of the bin.)
 - Another group could spread newspaper on each student's desk in the group and place one or two handfuls of worms and compost from the remaining contents of the bin on the newspaper. Students can pick out the worms from the compost as they listen to music or listen to a story.

For Older Students

- B. Do the following:
 - 1. When the compost has been separated from the worms, food, and remnants of bedding, ask students to weigh and record the weight of each of the following:
 - Compost

- Worms (worms can also be counted)
 - Food and remnants of bedding
2. Compare the present weights of the different components in the worm bin to their weights when they were added to the bin.
 3. Ask students to describe in their journals the sorting process for vermicompost.

Worm Investigations

We separated the red worms from the soil. They felt slimy. The worms were wiggling around.

How we did it:

First we got four piles of soil and worms from the worm bin. Then we put them in the sun and waited. After some time we put the soil in one container and worms in another container. Then my group collected food for the worms, such as apple cores, celery, and bread.

Submitted by Gayle MacDonald-Gura, third-grade teacher, Lower Lake Elementary School, Konocti Unified School District.

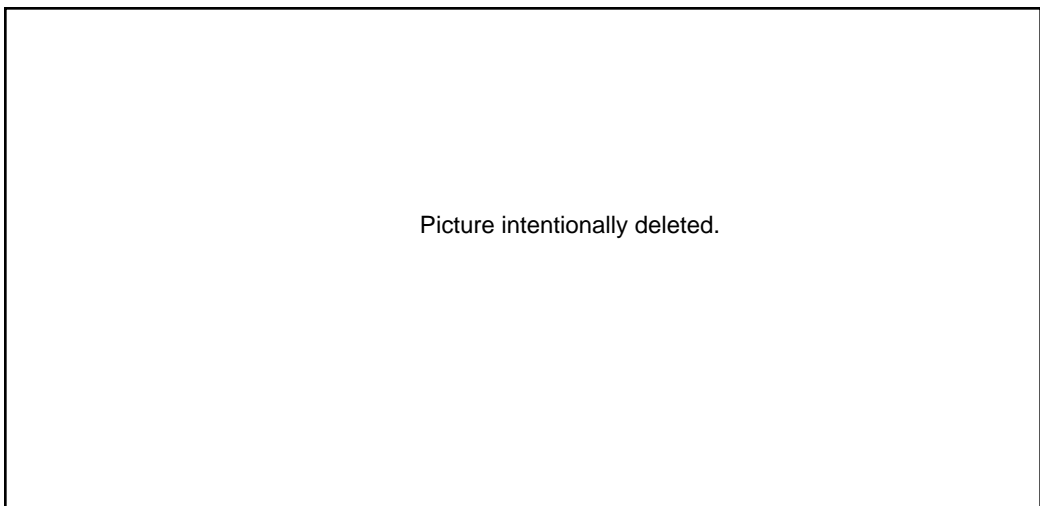
For All Students

- C. Continue the discussion the class started in “Pre-Activity Questions,” and have students decide what to do with the compost they collected.

- Students might want to add some compost to some potted plants or to plants growing on the school grounds (get approval from administrators first).
- Students could package the compost to sell and write up a vermicomposting information sheet.
- Students could use the compost to mix with soil in which to plant flowers for Mother’s Day or Father’s Day.
- Students could use the compost to test the growth of their plants. (This is described in “Part II.”)

Part II, Testing Whether Worm Compost Affects Plant Growth

- A. As a class, design an experiment with plants to see whether worm castings can actually make plants healthier and/or grow faster. With the class develop:
 - A hypothesis—what students think will happen
 - An experiment
 - Criteria for what will be considered healthy (very green leaves, lots of leaves) for a plant
 - A way to monitor the growth of the plants (For example, measure how tall and how wide they are; count the number of leaves; compare the size of leaves.)



Students from Mario Chang’s second-grade class at Mission Education Center sort vermicompost on the school grounds.

- A plan for using the same type of plants to compare and for making certain that all plants get the same amount of water and sunlight
- B.** One way to set up this experiment is described below:
- Use six plants from the same species (e.g., coleus or beans).
 - Two plants (A1 and A2) could be planted in soil from the school yard or an empty lot.
 - Two plants (B1 and B2) could be planted in one-fourth worm castings and three-fourths soil.
 - Two plants (C1 and C2) could be planted in half soil and half sandy or clay soil.
 - Have students observe and record over time any differences in the health and growth of each type of plant.
 - Plants will need to receive the same amount of water and sunlight.

Note: It is possible that no visible difference becomes evident. If there are no visible differences, this might show that using castings in replacement of soil is as good as soil. Also, there may not be significant differences if the soil in which the plants were planted was full of nutrients. The type of plants selected for this experiment might also affect the results. Some plants are adapted to thrive in poor soil.

- C.** Have students conduct their experiments.
- D.** After several weeks, discuss the results of the experiment. Ask whether students found out what they wanted to know and what else they might want to know (e.g., the ideal amount of worm compost for a specific plant). List students' responses on the chalkboard. Consider encouraging students to plan additional experiments. These can be done as a class, in groups, in pairs, or on an individual basis.

Note: Another way to test vermicompost is to use two outdoor planter boxes. Place several cups of vermicompost in the soil in one planter box and no vermicompost in the other planter. Using poor quality soil could show more dramatic results. Plant a variety of flowers, using the same species in both planters. Water both planters with the same amount of water.

Part III, Reading or Listening to the Stories, *Miss Rumphius* and *Johnny Appleseed*

- A.** Read to or have students read *Miss Rumphius* by Barbara Cooney and *Johnny Appleseed* by Eva Moore. (See section "B" and, if the compost is ready, decide whether you want students to separate the worms from the compost as you read one of the books.) After reading each book, ask students what was special about what each character did. *Miss Rumphius' grandfather worked to make the world better and taught Miss Rumphius to do the same. Miss Rumphius wanted to make a better world, so she planted flowers called lupines to make places more beautiful. Johnny Appleseed was making a better world by planting apples trees and giving away seeds and seedlings for others to plant and enjoy.*
- B.** Ask students what they could do on the school grounds to make it look better. *Plant plants.* Students might also say that helping the existing plants by using compost to enhance the growth of plants might be a good idea. The compost from vermi-composting can be used as fertilizer for existing plants and/or to grow new plants.

Project Idea: If students say that planting some plants on the school grounds would make it look better, help students to plan and implement this project.

Part IV, Making a Red Worm Mascot, a Sock Puppet, or a Clay Model

- A.** Show the transparency of "A Red Worm," from Lesson 2. Have some students help you make a model worm mascot out of nylon stockings while other students make their own worm out of socks or mold worms out of clay. To make the red worm mascot out of nylon, do the following or use the directions, "Making a Worm Mascot" by Donna Flores, at the end of this lesson.
- Stuff a nylon stocking with newspaper and tie string or yarn to make segments.
 - Make a flap over the mouth out of construction paper. (Have students determine how to make one.)
 - Brainstorm ways to make setae on its body.
 - Add the clitellum, the swelling or band

which is usually distinguished by its lighter color. This could be done using a piece of lighter shade of stocking tied around the first third of the worm.

- When the mascot worm is complete, have the class come up with a name for the mascot.

Picture intentionally deleted.

A student from Lynda Mooney's first-grade class at Las Palmas Elementary School holds up a model worm mascot.

- B. Provide a sock for each student who wants to make a sock worm puppet. Students should already know that real red worms do not have eyes and that they have five hearts (see Lesson 2 for more information). If lighter colored socks are used, students can use markers to darken the clitellum and add the bands to show segments. Students can also draw the hearts. If darker colored socks are used, students can glue pieces of construction paper for the segments, clitellum, and the hearts. If students do not want a puppet, they can stuff the sock with newspaper and use yarn to make segments and to close the end of the worm.
- C. Provide clay for those students who want to mold their worms.
- D. After all the members of the class have completed their worms, ask students to show their worms to the class.
- E. Have students use the red worm mascot, puppet, or model to share with the class one thing they know about worms or vermicomposting. Students should not repeat what other students have said.

Project Idea: Have students put together the information they shared in a script for a puppet show. Arrange for your students to go to other

classes to present their puppet show about red worms and vermicomposting. This show can also be presented during a school assembly and at the school's open house.

DISCUSSION/QUESTIONS

- A. Why is vermicomposting important? *It reduces the amount of garbage that goes to a landfill; the compost can be used to enrich the soil so that plants and soil animals grow better; it provides food for red worms.*
- B. What are the steps to harvesting the compost in a vermicomposting bin? (See "Background Information for the Teacher.")

APPLICATION

Do "A" or "B" (or both with older students).

- A. Discuss with students why people should know about vermicomposting. *It is a way to keep food waste from being landfilled; it is a way to recycle nutrients.*
 - Develop as a class a bank of key phrases that support important ideas about vermicomposting.
 - Break students into cooperative learning groups and ask them to develop posters that advertise one of the key concepts.
 - With permission from administrators, have students hang up some of the posters throughout the school. Make sure that these posters do not end up as litter.

Note: With younger students, you might want to do the following as a class or set up stations:

- B. Ask students to meet in groups and decide what they want to do to share what they know about red worms and vermicomposting. For example, they can:
 - Write and recite a poem about red worms.
 - Write and sing a song about red worms. (For ideas students can watch the Banana Slug String Band's video listed in "Resources." Although no song about red worms is featured, students can get ideas for words from songs about other animals.)
 - Write and read a story about red worms.
 - Explain something about vermicomposting through the imaginary character "Professor Red Worm."

- State several facts about red worms.
- Make a mural, painting, or illustration about red worms or vermicomposting and have the worm puppet or clay model explain it.

Red Worm

Red worm, red worm, grows so slow,
Red worm, red worm, way to go.
Red worm, red worm, eat a few leaves,
Red worm, red worm, compost these.

Oh, Lovely Invertebrate

No eyes, no ears, no nose,
You live where fungus grows;
You have a clitellum, so we know
you'll mate.
Oh, lovely invertebrate, you are so great.

Submitted by Gayle MacDonald-Gura's third-grade class, Lower Lake Elementary School, Konocti Unified School District.

Project Idea: Students could package the vermicompost and sell it to parents or other community members. Students could also include information about the benefits of vermicomposting or how to build and maintain a worm bin.

Project Idea: Students could organize and conduct an annual worm festival. They could develop stations for students from other classes to visit. A demonstration on how to vermicompost can also be included.

EXTENSIONS

1. Have groups of students put on a puppet show demonstrating how worms help to recycle our food waste.
2. Have your class visit a local community garden. Have students ask about composting or have a gardener visit the class.
3. Have students learn about composting without worms. See "Books" in the "Resources" section.

RESOURCES

Videos

Dancing with the Earth. Banana Slug String Band. Available from The Let's Get Growing! Company, 1900 Commercial Way, Santa Cruz, CA 95065; 1-800-408-1868; FAX (408) 476-1427 (40 minutes).

Shows the Banana Slug String Band performing its songs, including "Dirt Made My Lunch" and "Decomposition."

The Rotten Truth. Pleasantville, N.Y.: Sunburst Communications, 1991 (30 minutes).

Describes how to compost.

Books

Backyard Composting: Your Complete Guide to Recycling Yard Clippings. Prepared by Harmonious Technologies. Ojai, Calif.: Harmonious Press, 1992.

A step-by-step guide on how to compost.

Bond, Ruskin. *Cherry Tree.* Illustrated by Allan Eitzen. Honesdale, Penn.: Caroline House, 1991.

A girl in northern India plants a cherry seed and cares for it as it grows into a fruit producing tree.

Campbell, Stu. *Let It Rot! The Gardener's Guide to Composting.* Pownal, Vt.: Storey Communications, Inc., 1990.

Provides background information on composting and explains various ways to compost.

Cooney, Barbara. *Miss Rumphius.* New York: Viking, 1982.

A story about Miss Rumphius, who plants lupine because she believes that people should do something to make the world more beautiful.

Ikeda, Daisaku. *The Cherry Tree.* New York: Alfred A. Knopf, 1991.

Story about an old man and two children attempting to save a cherry tree in time of war.

Moore, Eva. *Johnny Appleseed.* New York: Scholastic, Inc., 1970.

The story of Johnny Chapman who got the nickname of Johnny Appleseed because of his enthusiasm about planting apple trees and his generosity in providing apple seeds to settlers.

MAKING A WORM MASCOT

by Donna Flores

Materials:

- ___ One thigh high nylon
- ___ One tan piece of felt
- ___ One yard of burgundy quilted material
- ___ Black thin yarn
- ___ Glue gun

1. Roll the burgundy quilted material lengthwise.
2. Slide material into nylon.
3. Knot the open end of the nylon.
4. Cut the elastic and excess nylon close to the knot.

Picture intentionally deleted.

Two students from Donna Flores's third-grade class at Nightingale Elementary School hold two worm mascots made in class.

Segments

5. Make segments by tying black yarn around the worm about every four inches.

Clitellum

6. Cut the felt in half. Roll one piece lengthwise and put it around the worm about one-third of the way down from the head's end. Use a glue gun to fasten the edge across. This is the clitellum.

Flap

7. From the other piece of felt, cut a "U" shape. This is the flap that goes on top of the head. Use a glue gun to glue it down.

Bristles

8. Cut yarn into one-and-one-half to two-inch pieces. (You need enough for one pair for each segment.) Fold the cut yarn in half. Drop some glue where you want the bristle and apply the folded yarn.

BACKGROUND INFORMATION FOR THE TEACHER

The following provides directions for harvesting compost from the worm bin:

Note: Be sure to monitor your bin and harvest the compost when the contents of the bin become mostly castings. The worms will stay in the bin if they have proper bedding, moisture, temperature, and food. Without those things, they may try to leave the bin in search of better living conditions, or they could die.

After a period of three to six months, you will notice that the food and bedding in the worm bin have been almost completely transformed into worm castings, the nutrient-rich waste material that worms excrete. Now is the time to harvest the compost and change the bedding.

- The first step is to assign a group of students to prepare new bedding for the worms while another group of students harvests the compost. (For directions on how to prepare bedding, see the K-3 Module, Unit 3, Lesson 1, “Procedure, Part I, Section C” or “Appendix D.”)
- Put down a sheet of plastic (e.g., a drop cloth, a plastic table cloth) approximately four feet by six feet for the second group of students. Spread it out in an open area (the floor or

outside on the playground). Dump the entire contents of the bin out onto the plastic sheet—worms, food, remnants of bedding, and castings.

- Sort the material into several (six to nine) cone-shaped piles (wider at the base and narrower at the top). If outside, allow sunlight to shine on the piles. If indoors, put a bright light over them, or ensure that the room is well lit. Since worms dislike light, they will burrow down deep into the pile to avoid it. Gradually scoop off materials from the tops of the piles; you will be able to watch most of the worms bury themselves deeper in the pile. Put the vermicompost (worm castings) in a container. The vermicompost can be used later to enhance the soil for house plants or gardens or to use in plant experiments. Put the worms in a second container, and put any uncomposted food waste or old bedding into a third container.
- When you reach the bottom of the piles, you will find a lot of worms. Put them in the container with the other worms. When all of the piles are sorted, add the container with the uncomposted food waste and old bed-

ding to the bin where the first group of students has placed the new bedding.

- Then place the worms in the bin. Allow the bright light to shine on them for a few minutes so that they bury themselves in the new bedding. Then add some fresh food waste, cover with shredded paper, put the cover on your worm bin, and have your students continue to feed and monitor the bin for another three to six months.

Picture intentionally deleted.

Students from Mario Chang’s second-grade class at Mission Education Center make a garden box before enhancing the soil with vermicompost.